

Enwex rulebook - version 2025

for German indices

Enwex Energy Weather Indices are created to meet the optimum between accuracy of represented weather development and simplicity for a sufficient understanding by traders and markets. Enwex is registered (EUIPO reg. Nr. 018892447) and immutable per yearly version once published along the following methodology:

1.) Index basics

- Generally, any Enwex Index is representing a market region or countrywide means.
- Whenever possible, the largest political units, e.g. provinces or federal states, with their fraction of supply (wind, solar) or demand (via population for temperature products) determine the weight of the representative grid point.
- These grid points per province are determined as the nearest one to the middle of a province. For each parameter the same gridpoint per province is used.
- The spatial resolution of the grid is 0,25° Lat Lon, the temporal resolution is hourly.
This temporal resolution will persist in case of markets allow 15-minute resolution of prices, as weather models are decisive for Enwex. So for derivatives on Enwex, e.g. market values, the power prices will be averaged for the forecasted hour and then multiplied by the utilisation figure of Enwex.
- Weather parameters currently translated into Enwex Indices:
 - a) Temperature: by population weight per region.
 - b) Wind: by installed capacity per region along transparent datasets as listed in **Appendix 1**. Wind indices are just representing onshore capacities.
 - c) Solar: by installed capacity per region along sources as listed in **Appendix 1**.
- Day ahead settlement data of Enwex Indices for Germany are published at 10:00 AM local time at www.enwex.com .

2.) Index update routine (yearly)

- Index weightings for renewables need a yearly versioning due to newbuild. Therefore total and regional installed capacities are based on most recent available figures at 1. September of each year with maximum time lag accepted of eight months (= end of previous calendar year). If there is no update on regional installed capacities younger than 31. December of previous year, the weighting for the affected country stays unchanged the current yearly version.
- New yearly versions will be calculated on the back of published capacity and their spatial distribution data and published by Enwex at 1. October in its API with the new ending, e.g. for 2026 named "..._v26". The official day ahead settlement publications will change their underlying weighting with change of calendar year, so in this example from 1. January 2026. The period in Q4 is thought for review by the market participants on the potential changes.
- For Wind and Solar the underlying weights are updated in a yearly routine, for Temperature in a 5-year routine with the next update for the version of 2030 (note: for reasons of consistency, actual temperature timeseries will also be named along the current trading years, e.g. v26).
- For each yearly version there will also be an updated backward calculation to 1979 for reanalysis data and 2013 for EC oper day ahead data available.
- Previous yearly versions (e.g. v24) will continuously be calculated until no trade concluded is referring to it anymore with a maximum of five years backward, e.g. in year 2030 the v25 timeseries will not be updated anymore.
- Countrywide means and their actual weightings are calculated as regional MW installed divided by national total MW installed. Current values can be found at **Appendix 2**.

3.) Weather model specifications

- Weather model of choice is the operational model of European center for medium range forecast (ECMWF) in its 0.25 degree spatial resolution and the 00 UTC update.
- Model parameters used from ECMWF oper are:
 - a) Temperature: 2m temperature
 - b) Wind: windspeed in m/s out of 100m level of u-wind and v-wind
 - c) Solar: Incoming shortwave radiation at surface

- Timesteps: Hourly resolution for the forecast period day ahead in local time (e.g. for Germany in wintertime H+25 to H+49).
- Fallback routine:
In case of ECMWF model delay, fallback solution for index calculation is with identical method and parameters but using ECMWF operational with basis 12 hours before (12 UTC). This means for e.g. Germany (wintertime) then timesteps H+37 to H+61.
- Reanalysis data in API timeseries from 1979 onwards are calculated out of ERA5 models, <https://cds.climate.copernicus.eu/datasets/reanalysis-era5-single-levels?tab=overview> , using same weather parameters, spatial and temporal resolution as from EC oper.
- Historical data by EC oper and ERA5 for Enwex in the current and previous year's versions can be downloaded via Enwex API. For access and further information mailto info@enwex.com
- Handling weather models generation switch:
 - a) EC oper: Direct implementation of new models version after official release by ECMWF with unchanged spatial and temporal resolution. Historical Data in API stay unchanged and are always reflecting the latest state of EC oper model at day ahead settlement.
 - b) ERA5: With planned new generation of ERA6 (from end 2026?), all historical timeseries will be published with the next year's version (2027?) in ERA6 and ERA5 for comparison. The year after, those historical data series will just be available in the new ERA version.

4.) Index calculation per parameter

Weather parameters used and the formula per country for calculation of wind and solar utilization are part of the yearly update routine. To handle potential biases driven e.g. by technological improvements on the efficiency factor or the other way round, by aging effects, there is a technology coefficient.

For biases exceeding 0,5% in backtesting of the previous year's observation data (for Germany: Netztransparenz, Link: <https://www.netztransparenz.de/de-de/Erneuerbare-Energien-und-Umlagen/Freiwillige-Veroeffentlichungen/Wind-und-Solarenergie-Hochrechnung>), it will be modified by full % figure, e.g. +1,6% bias will lead to a factor of 1,02. A review of the formula and its coefficients is scheduled for the Enwex version v30, valid in 2030.

a) Temperature:

Enwex temperature = 2m temperature in ° Celsius

b) Solar:

Enwex solar = Utilization of installed solar capacity
= technology coefficient * (factor * shortwave radiation / 1000)

with:

technology coefficient = 1,00 (neutralizing general biases)

factor = varying per country (e.g., Germany 0,71)

shortwave radiation = ECMWF operational model output for incoming radiation at surface

current formula for Germany:

Solar(D) = 1,00 * (0,71 * shortwave radiation / 1000)

c) Wind:

Enwex wind = Utilization of installed capacity
= technology coefficient * ((maximum utilization + util addition) /
(1,0 + exp (start wind speed – slope * (windspeed – X-axis shift) – constant)) –
util addition)

with:

technology coefficient = 1,00 (neutralizing general biases)

Maximum utilization = Max average power output per installed capacity,
usually below 1,00 due to e.g., outages, revisions

Util addition = modifies slope, subtracted at end of formula to avoid influence
on maximum

Start wind speed = average turbine start speed

Slope = Steepness of exponential function

Windspeed = ECMWF operational model output for windspeed in 100m height

X-axis shift = Shift to avoid negative values with low wind

Constant = average roughness length of landscape

Note:

windspeed values smaller than start wind speed of turbines in this formula
providing negative results, therefore need to be replaced by 0.

Current formula for Germany:

Wind(D) = 1,00 * ((0,92 + 0,05) / (1,0 + exp(3,2 – 0,529 * (wind – 2,5) – 0,074)) – 0,05)

Appendix 1: Data sources on installed capacities

Germany:

- <https://www.bundesnetzagentur.de/DE/Fachthemen/ElektrizitaetundGas/ErneuerbareEnergien/EE-Statistik/start.html> (wind & solar, update from 16.9.24 including August 2024. Note: Possible changes of installed capacities in later updates do not get considered.)

Appendix 2: Countrywide means and their actual (v25) weightings

Germany

Province	Latitude	Longitude	temperature	wind	solar
Baden-Württemberg	48,50	9,00	13,4	2,9	12,6
Bayern	49,00	11,50	15,9	4,3	26,9
Brandenburg & Berlin	52,50	13,50	7,5	14,2	8,0
Hessen	50,50	9,00	7,6	4,2	4,6
MecklenburgVorpommern	53,75	12,50	1,9	6,1	4,3
Niedersachsen & Bremen	52,50	9,00	10,5	20,7	8,9
NRW	51,50	7,50	21,5	12,1	12,1
RheinlandPfalz & Saarland	50,00	7,25	6,1	7,4	6,3
Sachsen	51,00	13,50	4,8	2,2	4,7
SachsenAnhalt	52,00	11,75	2,6	8,7	4,8
SchleswigHolstein & Hamburg	54,25	9,75	5,7	14,3	3,9
Thueringen	51,00	11,00	2,5	2,9	2,9